

10-8 What is Ohm's law?

Objective ▶ Relate electric current, voltage, and resistance.

TechTerm

▶ **Ohm's law:** current in a wire is equal to the voltage divided by the resistance

I, V, and R Every closed circuit has an electric current (I), voltage (V), and resistance (R). Current, voltage, and resistance vary from circuit to circuit. Different power sources have different amounts of voltage. For example, a 9-volt radio battery has less voltage than a 12-volt car battery. The resistance varies depending on the type of wires used. The current is affected by the voltage and the resistance.

▶ **Name:** What three things does every closed circuit have?

Ohm's Law Even though the current, voltage, and resistance vary from circuit to circuit, there is a simple relationship among them. This relationship is called **Ohm's law**. Ohm's law states that the current is equal to the voltage divided by the resistance.

$$I = V/R$$

Suppose a 12-volt battery is connected to a circuit with a resistance of 6 ohms. What is the current?

$$I = V/R$$
$$I = 12 \text{ volts}/6 \text{ ohms}$$
$$I = 2 \text{ amps}$$

▶ **Describe:** What does Ohm's law state about the current, voltage, and resistance in an electric circuit?

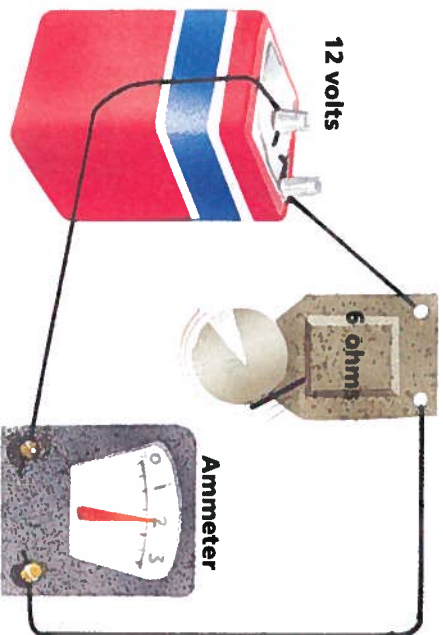


Figure 1

Using Ohm's Law As long as you know any two values, you can use Ohm's law to find the remaining value. Look at Figure 2. Cover the value you want to find. Then divide or multiply the other two values as shown to find the correct answer.

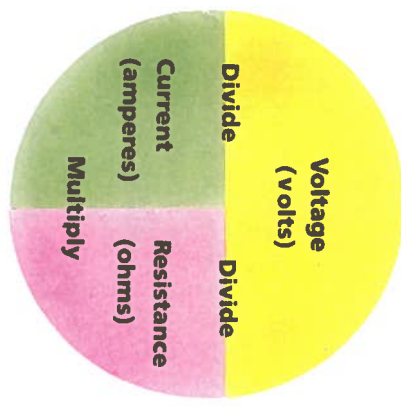


Figure 2

To find the voltage, multiply the current times the resistance.

$$V = I \times R$$

To find the resistance, divide the voltage by the current.

$$R = V/I$$

▶ **Calculate:** What is the resistance of a toaster that uses 5 amps of current when it is plugged into a 110-volt outlet?

LESSON SUMMARY

- ▶ Every closed circuit has current (I), voltage (V), and resistance (R).
- ▶ Ohm's law states that the current is equal to the voltage divided by the resistance, or $I = V/R$.
- ▶ Ohm's law can be used to find the value for I, V, or R if any two of the values are known.

CHECK Complete the following.

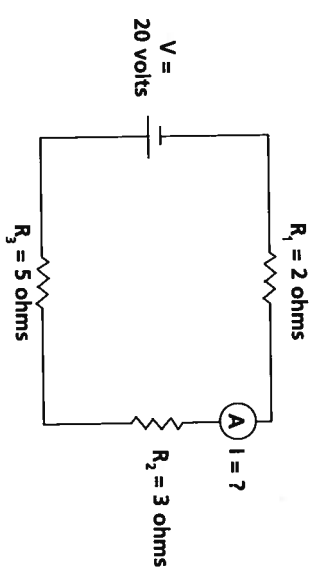
1. According to Ohm's law, $I = \text{_____}/R$.
2. If the resistance (R) in a circuit increases, the current (I) _____.
3. Every closed circuit has current, resistance, and _____.
4. If the voltage in a circuit decreases and the resistance stays the same, the current _____.

APPLY Copy the table at the top of the next column on a sheet of paper. Use Ohm's law ($I = V/R$) to complete the table.

I (amps)	V (volts)	R (ohms)
	10	70
15	250	
5		25
5	110	

Skill Builder

▶ **Analyzing** You can use the equation for Ohm's law to analyze circuit diagrams. The circuit diagram shows a series circuit with three resistors. The total resistance is the sum of all the resistances in the circuit. The power source is a 20-volt battery. What is the current in the circuit?



CAREER IN PHYSICAL SCIENCE

ELECTRICIAN

An electrician is a person who is trained to install and repair electrical equipment. An electrician must know how much electricity a building needs. A house with basic appliances such as a refrigerator and a television needs a certain amount of electricity. A high-rise apartment building needs much more.

Most homes have wall outlets that supply 120 volts. Appliances made in Europe are sometimes meant for a different voltage. An electrician needs to make sure that the correct amount of voltage is being used. An electrician must be familiar with different types of wires. Most houses use copper wiring, but some use aluminum. Older homes may need to have all the wiring replaced. An electrician needs to make sure that the correct type of wiring is used. People interested in a career as an electrician should take courses in mathematics, physics, and chemistry in high school.

